

IN THE CLAIMS:

- 1 1. (PREVIOUSLY PRESENTED) An intermediate network device for use in a com-
2 puter network having a plurality of entities configured to issue requests to reserve net-
3 work resources for use by traffic flows, the reservation requests specifying one or more
4 flow parameters, the intermediate network device comprising:
- 5 a traffic scheduler having one or more network resources for use in forwarding
6 network traffic received at the device at different rates;
- 7 a classification engine configured to identify network messages belonging to re-
8 spective traffic flows based upon predefined criteria;
- 9 a resource reservation engine in communicating relationship with the traffic
10 scheduler and the classification engine, the resource reservation engine including a flow
11 analyzer that is configured to apply one or more sets of predefined heuristics that are ac-
12 cessible by the flow analyzer to the one or more flow parameters specified in the reserva-
13 tion requests to determine a type of traffic of the given traffic flow, the one or more sets
14 of heuristics to determine the type of traffic independent of any marking values in packets
15 of the given traffic flow that identify traffic type, and the flow analyzer further config-
16 ured to select a queue and/or a queue servicing algorithm for assignment to the traffic
17 flow corresponding to the reservation request
- 1 2. (ORIGINAL) The intermediate network device of claim 1 wherein
- 2 the classification engine is directed to identify network messages belonging to the
3 traffic flow, and
- 4 the traffic scheduler is directed to place network messages identified as belonging
5 to the traffic flow in the selected queue.

1 3. (ORIGINAL) The intermediate network device of claim 1 wherein
2 the selected queue is one of a priority queue (PQ) and a reserved queue, and
3 the PQ is drained before any other queues.

1 4. (ORIGINAL) The intermediate network device of claim 3 wherein
2 a first set of heuristics is provided for determining whether the respective traffic
3 flows carry real-time voice information, and
4 traffic flows that are determined to carry real-time voice information are assigned
5 to the PQ.

1 5. (ORIGINAL) The intermediate network device of claim 4 wherein the flow parame-
2 ters include one or more of an average data rate, a peak data rate and a token bucket rate.

1 6. (ORIGINAL) The intermediate network device of claim 4 wherein
2 the resource reservation engine utilizes the Resource reSerVation Protocol
3 (RSVP) specification standard, and
4 the flow parameters are located in a RSVP Reservation (Resv) message received
5 by the device.

1 7. (ORIGINAL) The intermediate network device of claim 6 wherein the flow parame-
2 ters include one or more of a token bucket rate (r) value, a token bucket size (b) value and
3 a peak data rate (p) value.

1 8. (ORIGINAL) The intermediate network device of claim 7 wherein a first set of prede-
2 fined heuristics is given by the following equation:

3
$$(r \leq r') \text{ AND } (b \leq b') \text{ AND } \frac{p}{r} \leq p_to_r'$$

4 where,

5 r' is a programmable token bucket rate constant, b' is a programmable token
6 bucket size constant, and p_to_r' is a ratio of peak data rate to token bucket rate con-
7 stant.

1 9 (ORIGINAL) The intermediate network device of claim 8 wherein r' is approxi-
2 mately 12288 bytes/second, b' is approximately 592 bytes/second and p_to_r' is ap-
3 proximately 110 percent.

1 10. (ORIGINAL) The intermediate network device of claim 4 wherein
2 a reserved queue is selected for each traffic flow that does not satisfy the first set
3 of heuristics, and
4 a Weight Fair Queuing (WFQ) queue servicing algorithm is applied to the re-
5 served queues.

1 11. (ORIGINAL) The intermediate network device of claim 2 wherein the flow analyzer,
2 in response to the application of the one or more sets of heuristics, associates a selected
3 Per-Hop Behavior (PHB) with the traffic flow corresponding to the reservation request.

1 12. (ORIGINAL) The intermediate network device of claim 1 wherein

2 the resource reservation engine utilizes the Resource reSerVation Protocol
3 (RSVP) specification standard, and
4 the flow parameters are located in a RSVP Reservation (Resv) message received
5 by the device.

1 13. (PREVIOUSLY PRESENTED) In a computer network having a plurality of entities
2 interconnected by a plurality of intermediate network devices having one or more re-
3 sources for use in forwarding network traffic flows, a method for assigning queues and/or
4 queue servicing algorithms to the traffic flows, the method comprising the steps of:

5 receiving a reservation request message specifying one or more flow parameters
6 for a given traffic flow;

7 applying one or more sets of heuristics to the flow parameters of the received res-
8 ervation request message to determine a type of traffic of the given traffic flow, the one
9 or more sets of heuristics to determine the type of traffic independent of any marking
10 values in packets of the given traffic flow that identify traffic type; and

11 selecting a queue and/or a queue servicing algorithm for use with the given traffic
12 flow based on the application of the one or more sets of heuristics.

1 14. (PREVIOUSLY PRESENTED) The method of claim 13 wherein a first set of heuris-
2 tics is given by the following equation:

3
$$(r \leq r') \text{ AND } (b \leq b') \text{ AND } \frac{P}{r} \leq p_to_r'$$

4 where,

5 r is a token bucket rate value,

6 r' is a programmable token bucket rate constant,

7 b is a token bucket size value,
8 b' is a programmable token bucket size constant,
9 p is a peak data rate, and
10 p_to_r' is a ratio of peak data rate to token bucket rate constant.

1 15. (ORIGINAL) The method of claim 14 wherein r' is approximately 12288
2 bytes/second, b' is approximately 592 bytes/second and p_to_r' is approximately 110
3 percent.

1 16. (ORIGINAL) The method of claim 13 wherein
2 a first set of heuristics is provided for determining whether the respective traffic
3 flows carry real-time voice information, and
4 a given traffic flow that is determined to carry real-time voice information, based
5 on the first set of heuristics, is assigned to a priority queue (PQ) that is drained before all
6 other queues

1 17. (PREVIOUSLY PRESENTED) The method of claim 13 wherein a traffic flow that
2 is determined to carry other than real-time voice information is assigned to a selected re-
3 served queue.

1 18. (ORIGINAL) The method of claim 17 further comprising the step of applying a
2 Weight Fair Queuing (WFQ) queue servicing algorithm to the reserved queues.

1 19. (ORIGINAL) The method of claim 13 wherein the flow parameters include one or
2 more of an average data rate, a peak data rate and a token bucket rate.

1 20. (ORIGINAL) The method of claim 13 wherein the reservation request message cor-
2 responds to a Reservation (Resv) message as provided in the Resource reSerVation Pro-
3 tocol (RSVP) specification standard.

1 21. (ORIGINAL) The method of claim 20 wherein the flow parameters include one or
2 more of a token bucket rate (r) value, a token bucket size (b) value and a peak data rate
3 (p) value.

1 22. (PREVIOUSLY PRESENTED) An intermediate network device for use in a com-
2 puter network having a plurality of entities configured to issue requests to reserve net-
3 work resources for use by traffic flows, the reservation requests specifying one or more
4 flow parameters, the intermediate network device comprising:

5 means for receiving a reservation request message specifying one or more flow
6 parameters for a given traffic flow;

7 means for applying one or more sets of heuristics to the flow parameters of the
8 received reservation request message to determine a type of traffic of the given traffic
9 flow, the one or more sets of heuristics to determine the type of traffic independent of any
10 marking values in packets of the given traffic flow that identify traffic type, and

11 means for selecting a queue and/or a queue servicing algorithm for use with the
12 given traffic flow based on the application of the one or more sets of heuristics.

1 23. (PREVIOUSLY PRESENTED) The intermediate network device of claim 22, fur-
2 ther comprising:

3 means for providing a set of heuristics to determine whether the respective traffic
4 flows carry real-time voice information, and
5 means for assigning a traffic flow that is determined to carry real-time voice in-
6 formation, based on the set of heuristics, to a priority queue (PQ) that is drained before all
7 other queues.

1 24-31. (CANCELLED)

1 32. (PREVIOUSLY PRESENTED) The intermediate network device of claim 23
2 wherein the flow parameters are selected from the group consisting of: a token bucket
3 rate for the given traffic flow; a token bucket size for the given traffic flow; and peak data
4 rate for the given traffic flow.

1 33. (PREVIOUSLY PRESENTED) A method for assigning appropriate queues in an
2 intermediate network device to traffic flows that pass through the intermediate network
3 device, the method comprising the steps of
4 receiving a reservation request message specifying one or more flow parameters
5 that describe a given traffic flow;
6 comparing the one or more flow parameters to one or more constants stored in a
7 memory of the intermediate network device; and
8 in response to the step of comparing, determining a type of traffic for the given
9 traffic flow independent of any marking values in packets of the given traffic flow that
10 identify traffic type,
11 directing the given traffic flow to a queue adapted for the determined type of traf-
12 fic.

1 34. (PREVIOUSLY PRESENTED) The method of claim 33 wherein the determined
2 type of traffic is real-time voice traffic and the queue adapted for the determined type of
3 traffic is a priority queue (PQ) that is serviced with preference over other queues

1 35. (PREVIOUSLY PRESENTED) The method of claim 33 wherein a first one of the
2 one or more flow parameters is a token bucket rate and the step of comparing further
3 comprises the step of:
4 comparing the token bucket rate of the given traffic flow with a programmed to-
5 ken bucket rate constant descriptive of a particular type of traffic.

1 36. (PREVIOUSLY PRESENTED) The method of claim 33 wherein a first one of the
2 one or more flow parameters is a token bucket size and the step of comparing further
3 comprises the step of:
4 comparing the token bucket size of the given traffic flow with a programmed to-
5 ken bucket size constant descriptive of a particular type of traffic.

1 37. (PREVIOUSLY PRESENTED) The method of claim 33 wherein a first one of the
2 one or more flow parameters is a peak data rate and a second one of the one or more flow
3 parameters is a token bucket rate and the step of comparing further comprises the step of:
4 comparing the ratio of the peak data rate to the token bucket rate with a
5 programmed peak data rate to token bucket rate constant descriptive of a particular type
6 of traffic.

1 38. (PREVIOUSLY PRESENTED) The method of claim 33 wherein the marking values
2 are differentiated services codepoint (DSCP) values.

1 39. (PREVIOUSLY PRESENTED) The method of claim 33 further comprising the step
2 of:

3 associating a selected Per Hop Behavior (PHB) with the given traffic flow in re-
4 sponse to the step of comparing.

1 40. (PREVIOUSLY PRESENTED) An intermediate network device configured to as-
2 sign appropriate queues to traffic flows that pass through the intermediate network de-
3 vice, the intermediate network device comprising:

4 a communication facility configured to receive a reservation request message
5 specifying one or more flow parameters that describe a given traffic flow,

6 a flow analyzer configured to compare the one or more flow parameters to one or
7 more constants stored in a memory of the intermediate network device and to determine a
8 type of traffic for the given traffic flow independent of any marking values in packets of
9 the given traffic flow that identify traffic type; and

10 a traffic scheduler configured to direct the given traffic flow to a queue adapted
11 for the determined type of traffic.

1 41. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein the determined type of traffic is real-time voice traffic and the queue adapted for
3 the determined type of traffic is a priority queue (PQ) that is serviced with preference
4 over other queues.

1 42. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein a first one of the one or more flow parameters is a token bucket rate and the flow
3 analyzer is further configured to compare the token bucket rate of the given traffic flow
4 with a programmed token bucket rate constant descriptive of a particular type of traffic.

1 43. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein a first one of the one or more flow parameters is a token bucket size and the flow
3 analyzer is further configured to compare the token bucket size of the given traffic flow
4 with a programmed token bucket size constant descriptive of a particular type of traffic.

1 44. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein a first one of the one or more flow parameters is a peak data rate and a second
3 one of the one or more flow parameters is a token bucket rate and the flow analyzer is
4 further configured to compare the ratio of the peak data rate to the token bucket rate with
5 a programmed peak data rate to token bucket rate constant descriptive of a particular type
6 of traffic.

1 45. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein the marking values are differentiated services codepoint (DSCP) values.

1 46. (PREVIOUSLY PRESENTED) The intermediate network device of claim 40
2 wherein the flow analyzer is further configured to associate a selected Per Hop Behavior
3 (PHB) with the given traffic flow in response to the comparison.

1 47. (PREVIOUSLY PRESENTED) A computer-readable media containing executable
2 program instructions for assigning appropriate queues in an intermediate network device
3 to traffic flows that pass through the intermediate network device, the executable pro-
4 gram instructions comprising program instructions configured to:

5 receive a reservation request message specifying one or more flow parameters
6 that describe a given traffic flow;

7 compare the one or more flow parameters to one or more constants stored in a
8 memory of the intermediate network device; and

9 determine, in response to the comparison, a type of traffic for the given traffic
10 flow independent of any marking values in packets of the given traffic flow that identify
11 traffic type;

12 direct the given traffic flow to a queue adapted for the determined type of traffic.

1 48. (NEW) The method of claim 33 wherein the one or more flow parameters include a
2 token bucket rate, a token bucket size, and a peak data rate, and the step of comparing
3 further comprises:

4 comparing the token bucket rate with a programmed token bucket rate constant
5 descriptive of a particular type of traffic;

6 comparing the token bucket size with a programmed token bucket size constant
7 descriptive of the particular type of traffic; and

8 comparing the ratio of the peak data rate to the token bucket rate with a pro-
9 grammed peak data rate to token bucket rate constant descriptive of the particular type of
10 traffic.

1 49. (NEW) The intermediate network device of claim 40 wherein the one or more flow
2 parameters include a token bucket rate, a token bucket size, and a peak data rate, and the
3 flow analyzer is further configured to compare the token bucket rate with a programmed
4 token bucket rate constant descriptive of a particular type of traffic, compare the token
5 bucket size with a programmed token bucket size constant descriptive of the particular
6 type of traffic, and compare the ratio of the peak data rate to the token bucket rate with a
7 programmed peak data rate to token bucket rate constant descriptive of the particular type
8 of traffic.